भारतीय मानक
Indian Standard

IS 17017 (Part 2/Sec 2) : 2020

विद्युतीय वाहन चालकता चार्जिंग पद्धति

भाग 2 प्लग, साकेट – निकास, वाहन कनेक्टर्स, ओर वाहन के इनलेट्स

अनुभाग 2 a. c. पिन एवं कन्टैक्ट ट्यूब एस्सेसरी के लिए आयामीय संगतता एवं अंतर्विनिमेयता अपेक्षायें

Electric Vehicle Conductive Charging System

Part 2 Plugs, Socket – Outlets, Vehicle Connectors and Vehicle Inlets

Section 2 Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories

ICS 29.120.30, 43.120

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Electrotechnology in Mobility Sectional Committee, ETD 51

FOREWORD

This Indian Standard (Part 2/Sec 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Elecrotechnology in Mobility Sectional Committee had been approved by the Electrotechnical Division Council

This standard (Part 2) is the series of standards which covers the mechanical, electrical and performance requirements for dedicated plugs, socket outlets, vehicle connectors and vehicle inlets for interfacing between such dedicated charging equipment and the electric vehicle. This series consists of the following sections.

Section 1	General requirements, comprising clauses of a general character.
Section 2	Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories.
Section 3	Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers.

Considerable assistance has been obtained from IEC 62196-2: 2016 while preparing this standard. Most of the requirements of this standard correspond to the requirements of IEC 62196-2:2016 (except for the exemptions described in the following paragraphs).

The regulatory bodies, had decided that an India specific charging system be defined and the development of this has been entrusted to the Department of Science and Technology. As such, some provisions for inclusion of the outcome of this scientific exercise has been left in this standard. The standard will be modified/amended once the new design is validated and found stable.

The cross references of IEC have been modified to refer Indian Standards whenever available. Where corresponding Indian Standards are not available, the IEC references have been retained. The committee has decided that these IEC standards are suitable to be used till equivalent/corresponding Indian Standards are published.

The composition of the committee responsible for formulation of this standard is given at Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding of numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM

PART 2 PLUGS, SOCKET-OUTLETS, VEHICLE CONNECTORS AND VEHICLE INLETS

Section 2 Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories

1 SCOPE

This section of IS 17017(Part 2) covers requirements of plugs, socket-outlets, vehicle connectors and vehicle inlets with pins and contact-tubes of standardized configurations, herein referred to as accessories, with nominal rated operating voltage not exceeding 415 V a.c., 50 Hz and a rated current not exceeding 63 A three-phase or 70 A single phase, for use in conductive charging of electric vehicles.

This section of IS 17017 (Part 2) covers the basic interface accessories for vehicle supply as specified in IS 17017 (Part 2/Sec 1), and intended for use in conductive charging systems for circuits specified in IS 17017(Part 1):2018.

NOTES

1 Electric road vehicles (EV) implies all road vehicles, including plug-in hybrid road vehicles (PHEV), that derive all or part of their energy from RESS.

2 These accessories are intended to be used for circuits specified in IS 17017 (Part 1) : 2018 which operate at different voltages and frequencies and which may include extra-low voltage (ELV) and communication signals.

3 These accessories may be used for bidirectional power transfer (under consideration).

4 This standard applies to accessories to be used in an ambient temperature between -25°C outdoor to +55°C.

5 These accessories are intended to be connected only to cables with copper or copper-alloy conductors.

6 Vehicle inlet and vehicle connector to this standard are intended to be used for charging in modes 1, 2 and 3, cases B and C. The socket-outlets and plugs covered by this standard are intended to be used for charging mode 3 only, case A and B.

7 The modes and permissible connections are specified in IS 17017 (Part 2/Sec 1).

2 REFERENCES

This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

Addition:

IS 17017 (Part 2/Sec 1), Electric vehicle conductive charging system Part 2: Plugs, socket- outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Section 1: General requirements

3 TERMS AND DEFINITIONS

This clause of IS 17017 (Part 2/Sec 1) is applicable.

4 GENERAL

This clause of IS 17017 (Part 2/Sec 1) is applicable.

5 RATINGS

This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

Replacement:

5.1 Rated Operating Voltage

The rated operating voltage are:

a) 30 V (signal or control purposes only);
b) 240 V a.c.; and
c) 415V a.c.

5.2 Rated Currents

The rated currents are:

a) 2 A (signal or control purposes only);
b) 13 A single phase;
c) 16 A single and three-phase;
d) 20 A single and three-phase;
e) 30 A or 32 A single and three-phase;
f) 60 A or 63 A single and three-phase; and
g) 70 A single phase only.

6 CONNECTION BETWEEN THE POWER SUPPLY AND THE ELECTRIC VEHICLE

This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

Replacement:

6.1 General

This Clause provides a description of the physical conductive electrical interface requirements between the vehicle and the power supply which allows the following design at the vehicle interface:

- a basic interface that provides for current ratings up to 63 A a.c. three-phase and up to 70 A a.c. single phase.

Different configuration types for the basic interface may allow different application of mode and current ratings. See introduction to relevant standard sheets for more details.

6.2 Types of Vehicle Inlets

There is one type of vehicle inlet:

- Basic

6.3 Types of Vehicle Connectors

There is one type of vehicle connector:

- Basic

6.4 Not applicable

6.5 Basic Interface

The basic interface may contain up to 7 power or signal contacts, with unique physical configurations of contact positions for single or three phases. The electrical ratings and their function are described in Table 201. The electrical ratings and their function are described in the Standard Sheets.

Each vehicle inlet shall only mate with the corresponding type of vehicle connector. Each plug shall only mate with the corresponding type of socket-outlet.

The accessories, configuration types 2 vehicle coupler, socket-outlet and plug are rated:

Table 201 Overview of the Basic Vehicle Interface, Configuration Types 2, Three-Phase or Single Phase

(Clause 6.5)

Position Number[3]	*U*max	Three Phase	Single Phase	Functions
		*I*max	*I*max	
	V ac	A	A	
		Type 2	Type 2[1]	
1	440	63	70	L1 (mains 1)[1]
2	440	63	-	L2 (mains 2)
3	440	63	-	L3 (mains 3)
4	440	63	70	N (neutral)[1],[2]
5	—	Rated for fault		PE (ground/earth)
6	30	2		CP (Control pilot)
7	30	2		PP (Proximity) or CS (Connection switch)

[1] For single phase charging, contacts 1 and 4 shall be used.

[2] For single phase system supply phase to phase this contact can be used for L2 (mains 2).

[3] Position number does not refer to the location and/or identification of the contact in the accessory.

a) 240 V, 13 A or 20 A or 32 A or 63 A or 70 A single phase; and

b) 415 V, 13 A or 20 A or 32 A or 63 A, three-phase.

6.6 Not applicable.

Addition:

6.201 Communication and Control Pilot Function

The control pilot and proximity detection or connection contacts are intended to be used in accordance with IS 17017(Part 1).

7 CLASSIFICATION OF ACCESSORIES

This clause of IS 17017(Part 2/Sec 1) is applicable except as follows:

Replacement:

7.4 According to Electrical Operation

- Not suitable for making and breaking an electrical circuit under load for configurations type 2;

  NOTE — Communication circuits according to this standard are deemed not to make or break load as a result of this clause.

7.5 According to interface

Interface is specified in **6**.

- Basic type.

Addition:

7.201 According to the Standard Sheet used

- Configuration type 2.

8 MARKING

This clause of IS 17017 (Part 2/Sec 1) is applicable.

9 DIMENSIONS

This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

Replacement:

9.1 Accessories shall comply with the relevant standard sheets as specified below and in Table 202:

Configuration type 2

- 63 A, 415V three-phase or 240 V, 70 A single-phase accessories: standard sheets 2-II, IIa, IIb, IIc, IId, IIe, IIf, IIg and IIh.

10 PROTECTION AGAINST ELECTRIC SHOCK

This clause of IS 17017(Part 2/Sec 1) is applicable.

11 SIZE AND COLOUR OF PROTECTIVE EARTHING CONDUCTORS

This clause of IS 17017(Part 2/Sec 1) is applicable except as follows:

Table 202 Configuration Types and Standard Sheets

(*Clause* 9.1)

Configuration Type	Standard Sheet	Applicable Accessories	Rated Voltage V	Rated current A	Phase
2	2-II	Accessories	240	70	Single-phase
			415	63	Three-phase

Replacement:

The core connected to the earthing terminal shall be identified by the colour combination green-and-yellow. The nominal cross/sectional area of the earthing conductor and of the neutral conductor, if any, shall be at least equal to that of the phase conductors .

12 PROVISIONS FOR PROTECTIVE EARTHING

This clause of IS 17017 (Part 2/Sec 1) is applicable.

13 TERMINALS

This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

Addition:

13.201 Wire connection of components, for example coding resistors may be rewirable or non-rewirable.

14 INTERLOCKS

This clause of IS 17017 (Part 2/Sec 1) is applicable.

15 RESISTANCE TO AGEING OF RUBBER AND THERMOPLASTIC MATERIAL

This clause of IS 17017 (Part 2/Sec 1) is applicable.

16 GENERAL CONSTRUCTION

This clause of IS 17017 (Part 2/Sec 1) is applicable.

17 CONSTRUCTION OF SOCKET-OUTLETS

This clause of IS 17017 (Part 2/Sec 1) is applicable

18 CONSTRUCTION OF PLUGS AND VEHICLE CONNECTORS

This clause of IS 17017 (Part 2/Sec 1) is applicable

19 CONSTRUCTION OF VEHICLE INLETS

This clause of IS 17017 (Part 2/Sec 1) is applicable.

20 DEGREES OF PROTECTION

This clause of IS 17017 (Part 2/Sec 1) is applicable.

21 INSULATION RESISTANCE AND DIELECTRIC STRENGTH

This clause of IS 17017 (Part 2/Sec 1) is applicable

22 BREAKING CAPACITY

This clause of IS 17017 (Part 2/Sec 1) is applicable

23 NORMAL OPERATION

This clause of IS 17017 (Part 2/Sec 1) is applicable.

24 TEMPERATURE RISE

This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

24.1 This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

Addition, After the Seventh Paragraph:

For accessories dependent upon a resistor coding to define the accessory’s assigned current rating, the test shall be repeated using a set of samples for each resistor coding value and tested at the maximum current corresponding to that resistor coding value.

25 FLEXIBLE CABLES AND THEIR CONNECTION

This clause of IS 17017 (Part 2/Sec 1) is applicable.

26 MECHANICAL STRENGTH

This clause of IS 17017 (Part 2/Sec 1) is applicable.

27 SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS

This clause of IS 17017 (Part 2/Sec 1) is applicable.

28 CREEPAGE DISTANCES, CLEARANCES AND DISTANCES

This clause of IS 17017 (Part 2/Sec 1) is applicable.

29 RESISTANCE TO HEAT, TO FIRE AND TO TRACKING

This clause of IS 17017 (Part 2/Sec 1) is applicable.

30 CORROSION AND RESISTANCE TO RUSTING

This clause of IS 17017 (Part 2/Sec 1) is applicable.

31 CONDITIONAL SHORT-CIRCUIT CURRENT WITHSTAND TEST

This clause of IS 17017 (Part 2/Sec 1) is applicable.

32 ELECTROMAGNETIC COMPATIBILITY (EMC)

This clause of IS 17017 (Part 2/Sec 1) is applicable.

33 VEHICLE DRIVEOVER

This clause of IS 17017 (Part 2/Sec 1) is applicable except as follows:

33.4 Not applicable.

33.5 Not applicable.

201 COMPONENTS

NOTE This clause will be transferred to Section 1, Clause 4 in its next revision.

201.1 Ratings

A component shall be used in accordance with its rating established for the intended conditions of use.

Compliance is checked by inspection.

201.2 Mechanical Assembly

Loosening of parts in an accessory as a result of vibration due to storage, handling and operation shall not result in a risk of fire, electric shock, injury to persons.

Compliance is checked by inspection.

201.3 Current-carrying Parts of Incorporated Components

Any component uninsulated live part shall be so secured to the base or mounting surface, or otherwise insulated that the part does not turn or shift in position resulting in a reduction of creepage distances, clearances and distances below the minimum required values of **28** of IS 17017 (Part 2/Sec 1).

Compliance is checked by inspection.

201.4 Electrical Connections

201.4.1 The requirements described in **201.4.2** to **201.4.4** apply to connections of internal wiring that are factory installed in the accessory.

Compliance is checked by inspection.

201.4.2 A splice or connection shall be mechanically secure and shall make electrical contact.

Compliance is checked by inspection.

201.4.3 A soldered connection is determined to be mechanically secure when the lead is:

a) wrapped one full turn around a terminal;

b) bent at a right angle after being passed through an eyelet or opening, except on printed wiring boards where components are inserted or secured (as in a surface-mounted component) and wave-soldered or lap-soldered;

c) twisted with other conductors; or

d) an equivalent means.

Compliance is checked by inspection.

201.4.4 A splice shall be provided with insulation equivalent to that of the wires involved unless permanent clearance and creepage distances are maintained between the splice and other metal parts. Insulation over the splice is not prohibited from having:

a) a splicing device such as a pressure wire connector, having suitable voltage and temperature ratings,

b) insulating tubing or sleeving used to cover a splice.

Compliance is checked by inspection.

202 RESISTOR CODING

The vehicle connector and plug of configurations type 2 shall be provided with coding resistors (*R*c) to define the maximum current capability of the cable assembly and vehicle connector and plug.

The resistor values and tolerances shall be as specified in **B-2** of IS 17017 (Part 1):2018 - “Circuit for simultaneous proximity detection and current coding”.

Compliance is checked by inspection.

STANDARD SHEETS CONFIGURATION TYPE 2 STANDARD SHEETS 2-II

(Clause 9.1 *)*

63 A,415 V THREE-PHASE OR 70 A,240 V SINGLE PHASE ACCESSORIES

OVERVIEW

The standard sheets 2-II apply to configuration type 2: 63 A,415 V a.c. three-phase and 70 A, 240 V a. c. single-phase accessories.

For configuration type 2, the following specifications are applicable:

Interlocking and latching of the accessories is mandatory to prevent them from unintentional separation and breaking under load. The interlocking shall insure that the energy transmission is stopped before separation.

NOTE − Interlocking can be performed by mechanical or electromechanical means .

The interlocking means shall offer a feedback to show that the mechanism is in correct engagement. At least one latching means shall be provided. The feedback can be offered for example by a supplementary contact.

The pilot function shall be realized by implementation of “Control Pilot function through a control pilot circuit using PWM signal and a control pilot wire” as described in Annex A of IS 17017 (Part 1):2018.

Proximity detection and current coding shall be implemented according to “Circuit for simultaneous proximity detection and current coding” as per **B-2** of IS 17017 (Part 1):2018.

Interoperability of configuration type 2 accessories is indicated in Table 203.

Standard Sheets 2-IIg and 2-IIh define packaging rooms to ensure compatibility.

Table 203 Interoperation of Configuration Type 2 Accessories

Accessory[1]	Plug (mode 3) Sheet 2-IIb	Vehicle Inlet (all modes) Sheet 2-IId	Vehicle Inlet (modes 2 and 3) Sheet 2-IIf
Socket-outlet (mode 3) Sheet 2-IIa	Yes	n. a[4]	n. a[4]
Vehicle connector (mode 1) Sheet 2-IIc	No[2]	Yes	No[2]
Vehicle connector (modes 2 and 3)Sheet 2- IIe	No[3]	Yes	Yes

[1] Type 2 accessories shall only be used in the modes as listed in this tabulation.

[2] Interoperability excluded by mechanical coding.

[3] Interoperability excluded by gap in control pilot circuit.

[4] Fixed accessories cannot be connected together.

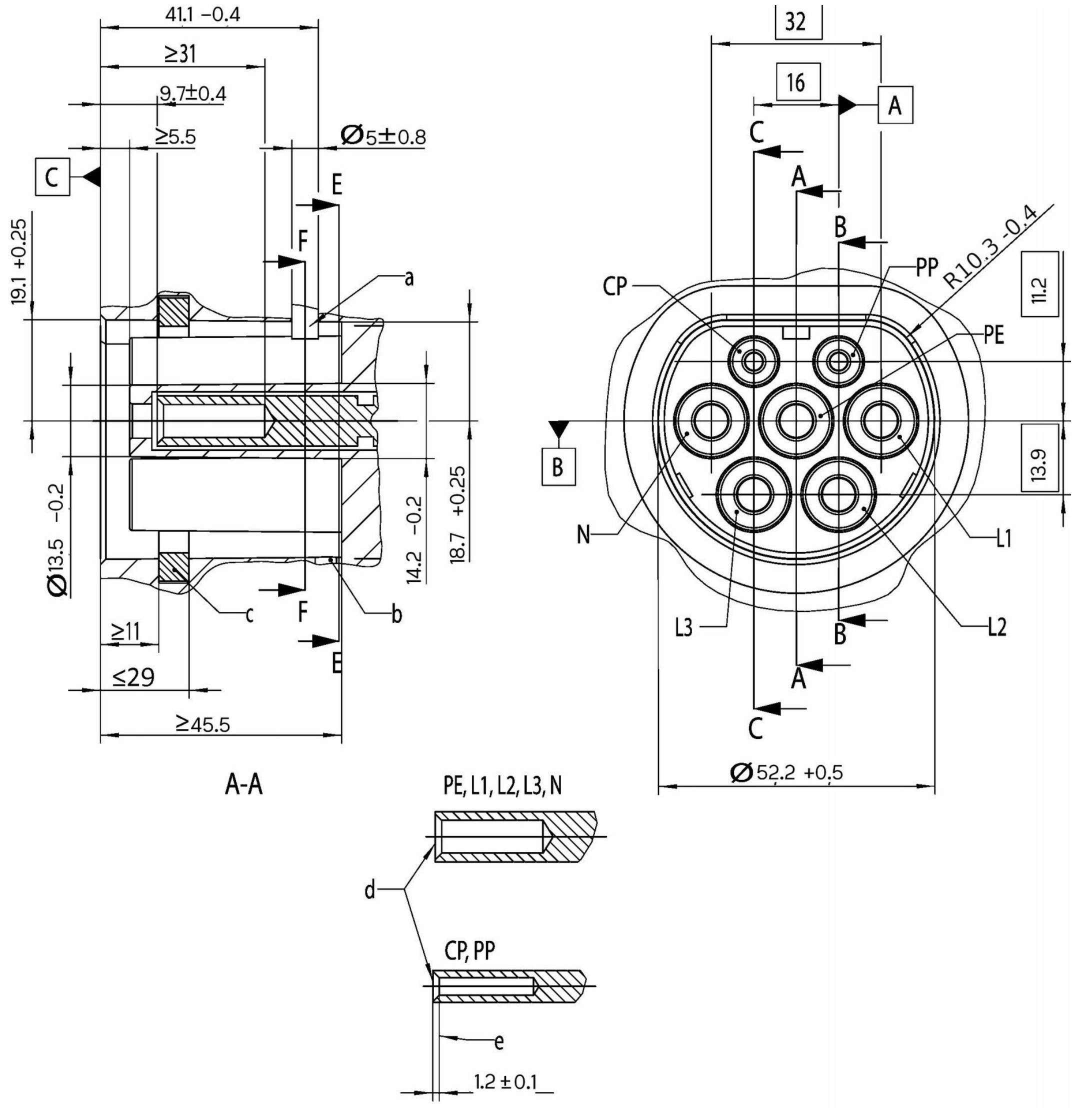
STANDARD SHEET 2-IIa

(Clause 9.1 *)*

Sheet 1

SOCKET-OUTLET

63 A, 415 V THREE-PHASE OR 70 A, 240 V SINGLE PHASE



Key

a	Latching means construction to customer’s decision
b	Optional drain hole
c	Sealing area (optional sealing). The plug area from 11 to 16,7 has to be kept free of shrinkage, tool cuts and ejector marks. See 2-IIb sheet 1.
d	Tip of sleeves chamfered for easy insertion
e	Contact point

NOTES

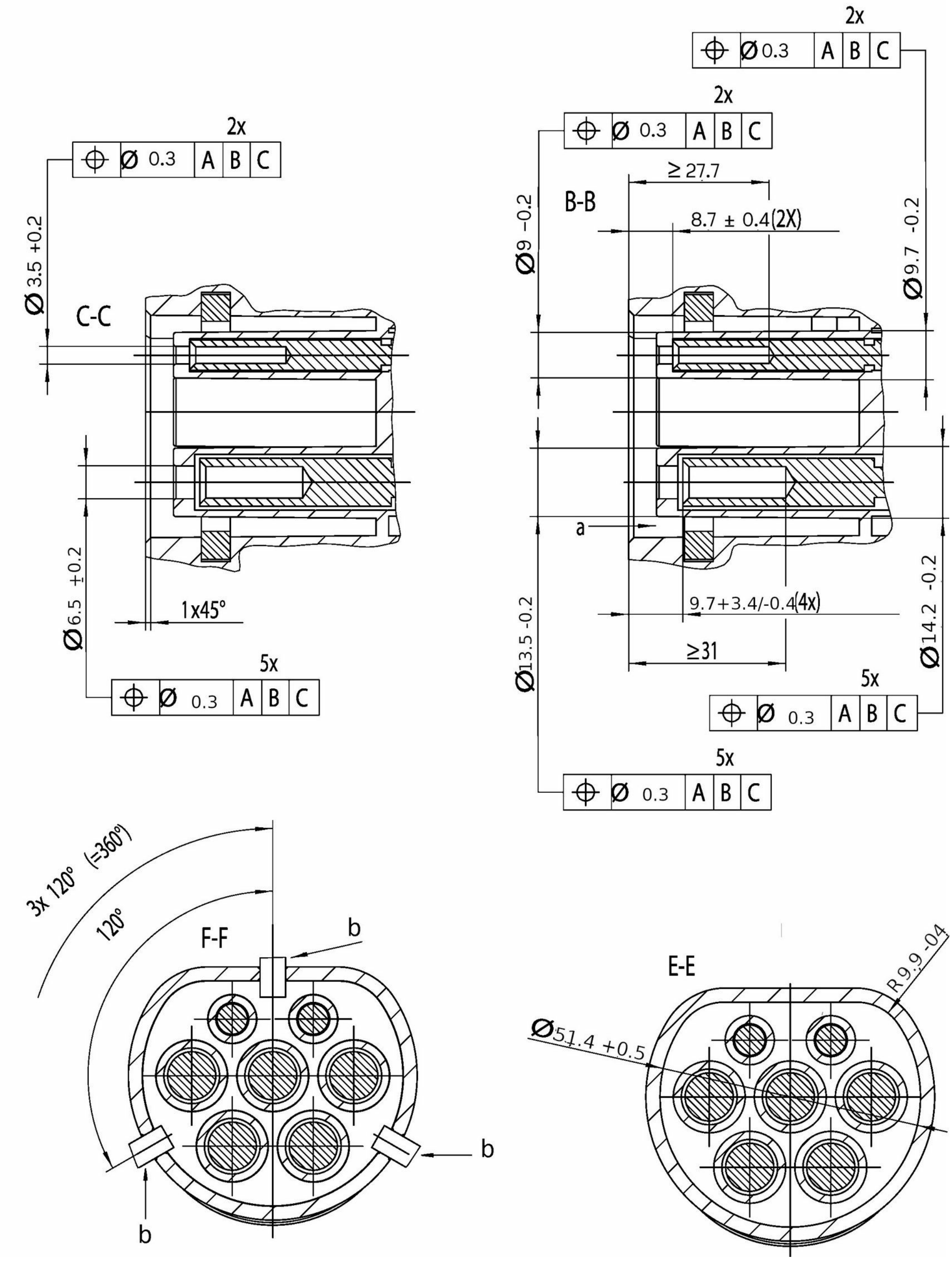
1 Undimensioned radii: R 0.5 mm to 0.7 mm

2 For single phase socket-outlets, contacts L2 and L3 including the surrounding insulation can be omitted

STANDARD SHEET 2-IIa

(Clause 9.1 *)*

Sheet 2 *(Continuation of Sheet 1)*



Key

a	Preferred area for optional shutter. Mechanism might exceed this area.
b	Latching means positions. At least one Latching means provided.

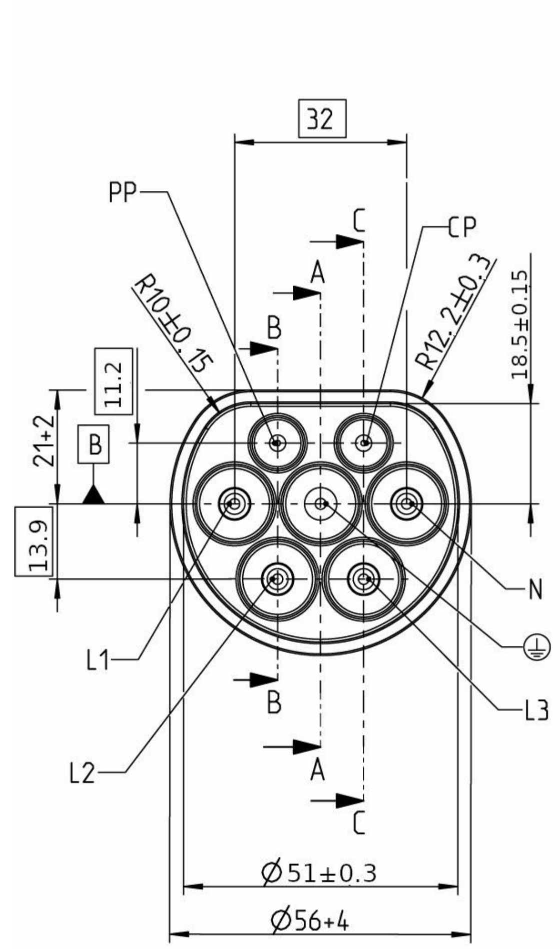
NOTE − Undimensioned radii: R 0.5 mm to 0.7 mm

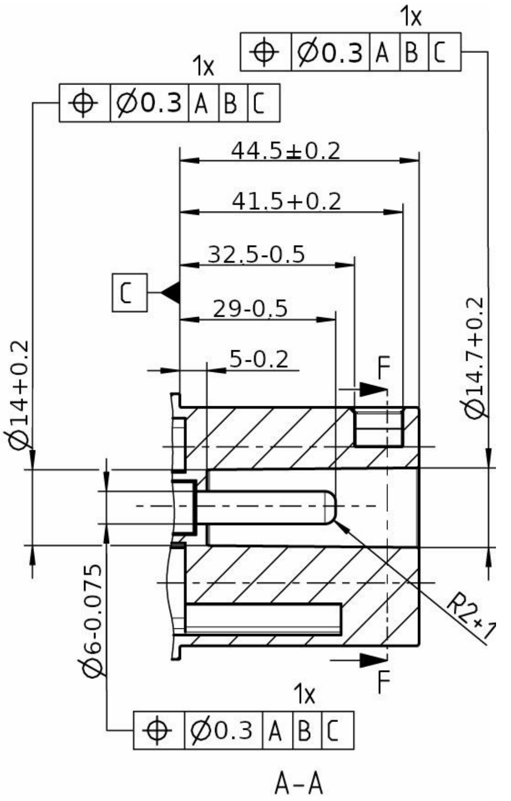
STANDARD SHEET 2-IIb

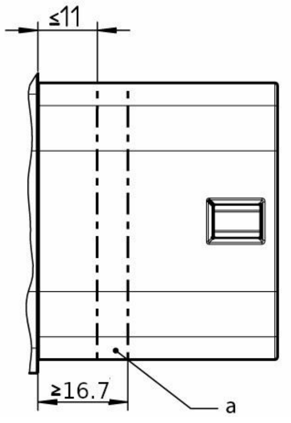
(*Clause* 9.1)

Sheet 1

PLUG
63 A, 415 V THREE-PHASE OR 70 A, 240 V SINGLE PHASE







Key

a Sealing area, free of sinkage, toolcuts and ejectors.

NOTES

1 Surface roughness in sealing area: Ra=0,7 µm

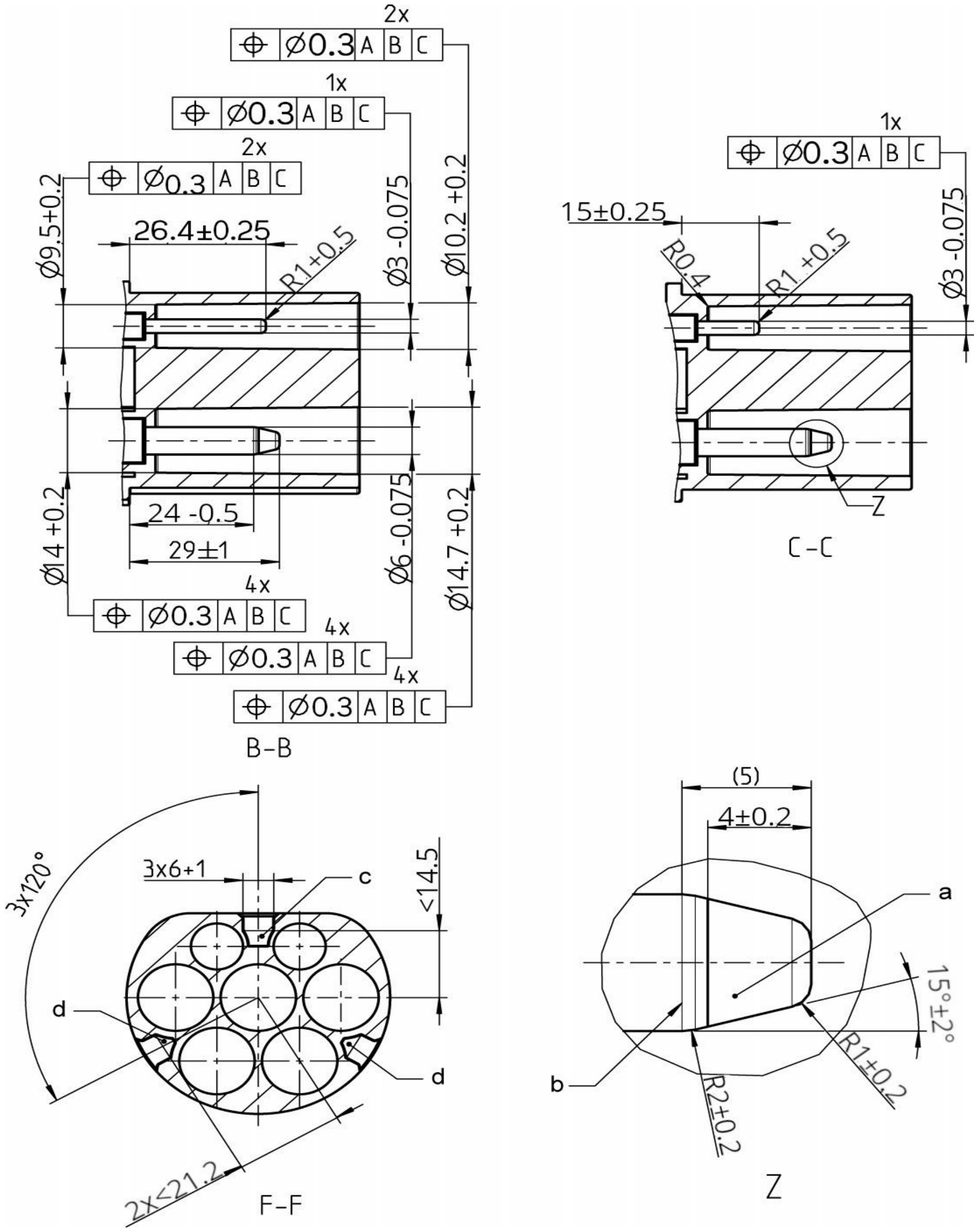
2 Undimensioned radii: R 0.5 mm to 0.7 mm

3 For single phase plugs the contacts L2 and L3 can be omitted.

STANDARD SHEET 2-IIb

(Clause 9.1 *)*

Sheet 2 *(Continuation of Sheet 1)*



Key

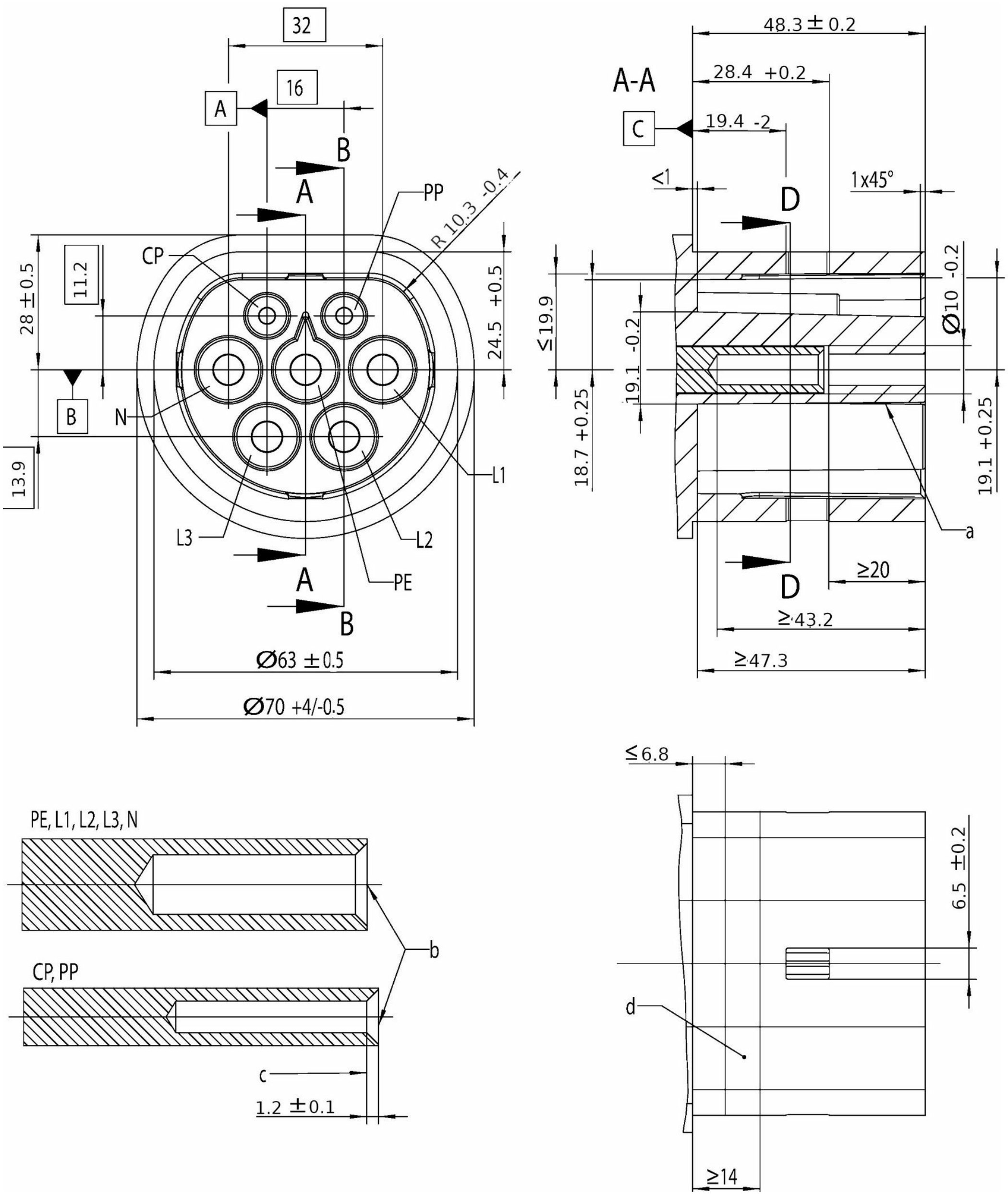
a	Isolated cap
b	No sharp edges acceptable at the transition region
c	The cavity shall have a rectangular shape with smooth edges with the dimensions indicated and shall be within the prescribed limits over the distance <14.5 mm. Beyond this, limits of the cavity may have a different shape and different dimensions.
d	The cavity shall have a rectangular shape with smooth edges with the dimensions indicated and shall be within the prescribed limits over the distance <212 mm. Beyond these limits the cavity may have a different shape and dimension.

NOTE − Undimensioned radii: R 0.5 mm to 0.7 mm

STANDARD SHEET 2-IIc

(*Clause* 9.1)

Sheet 1
VEHICLE CONNECTOR
63 A, 415 V THREE-PHASE OR 70 A, 240 V SINGLE PHASE



Key

a	All the domes may be shortened by 17.8 mm if a shutter is used
b	Tip of sleeves chamfered for easy insertion
c	Contact point
d	Sealing area free of sinkage, toolcuts and ejectors

NOTES

1 Undimensioned radii: R 0.5 mm to 0.7 mm.

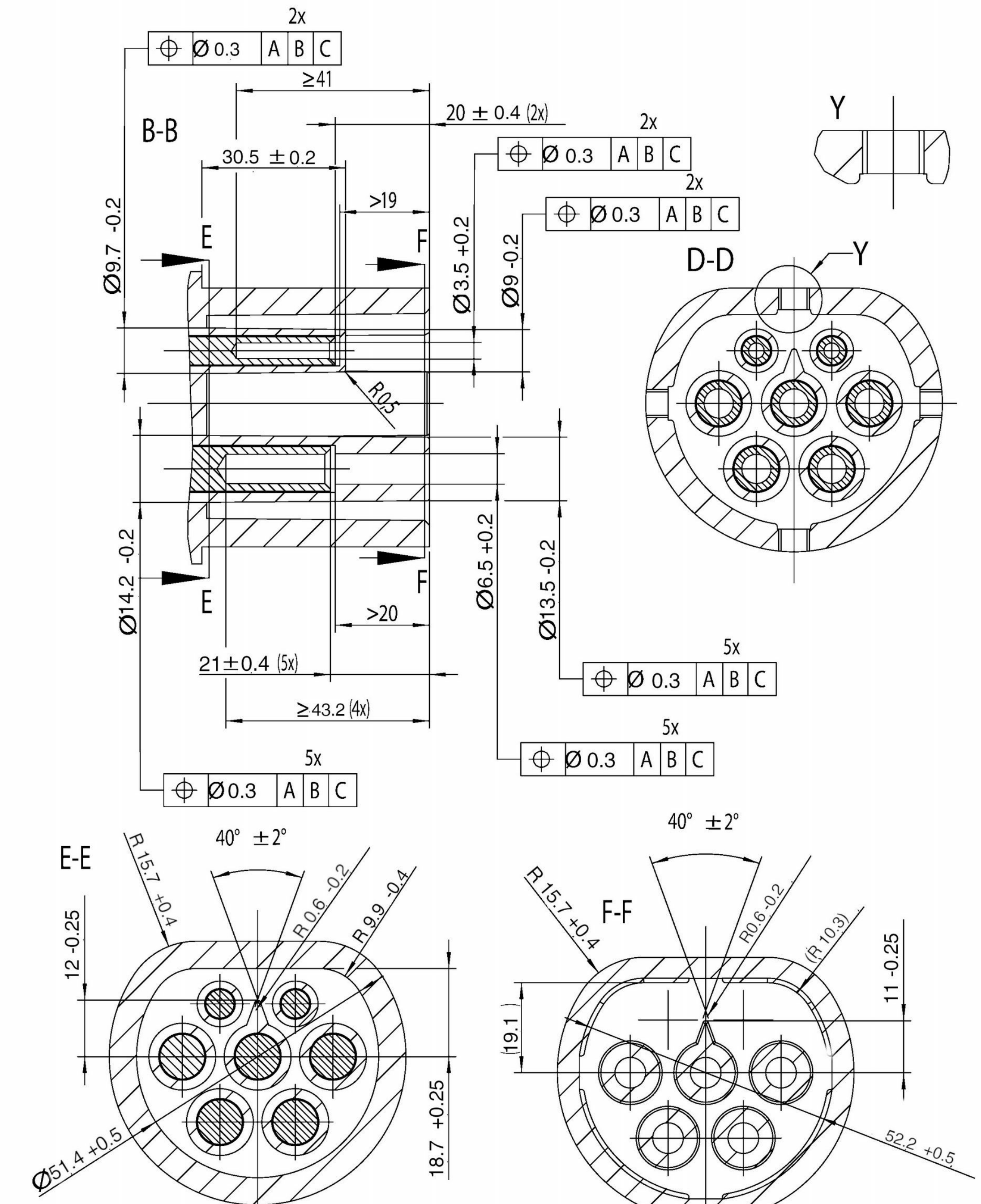
2 Surface roughness in sealing area: Ra=0.7 µm

3 For single phase connectors the contacts L2 and L3 including the surrounding insulation can be omitted

STANDARD SHEET 2-IIc

(Clause 9.1 *)*

Sheet 2 *(Continuation of Sheet 1)*



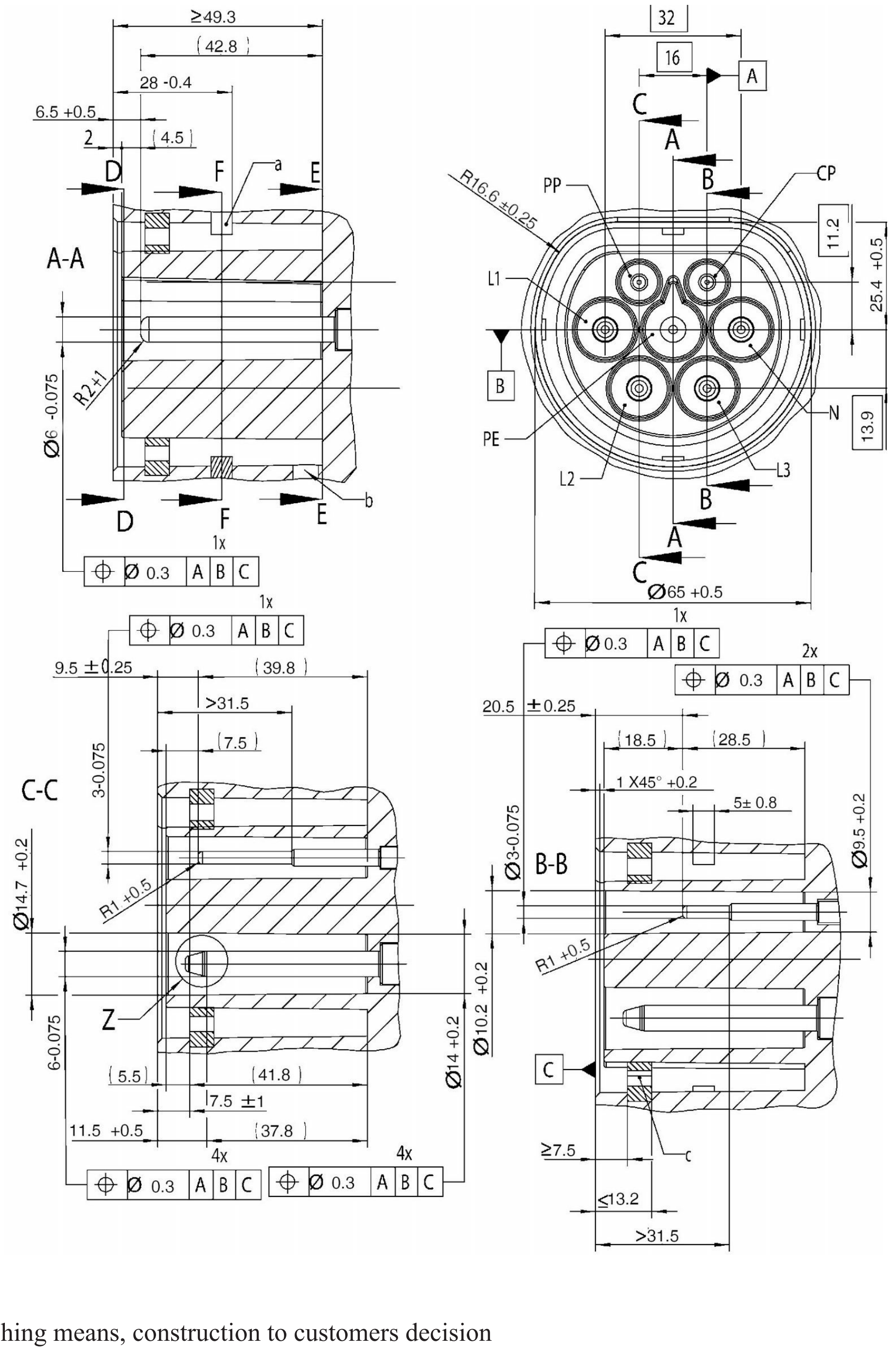
NOTE − Undimensioned radii: R 0.5 mm to 0.7 mm

STANDARD SHEET 2-IId

(Clause 9.1)

Sheet 1

VEHICLE INLET
63 A, 415 V THREE-PHASE OR 70 A, 240 V SINGLE PHASE



Key

a	Latching means, construction to customers decision
b	Optional drain hole
c	Sealing area (optional sealing)

NOTES

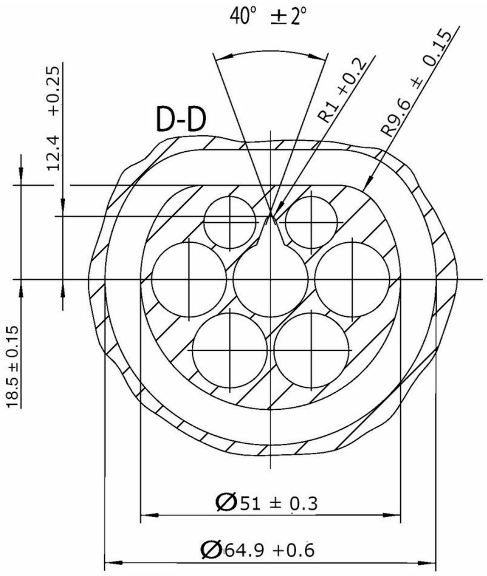
1 Undimensioned radii: R 0.5 mm to 0.7 mm

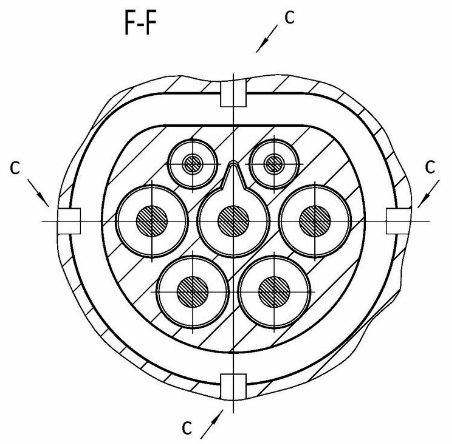
2 For single phase inlets the contacts L2 and L3 can be omitted.

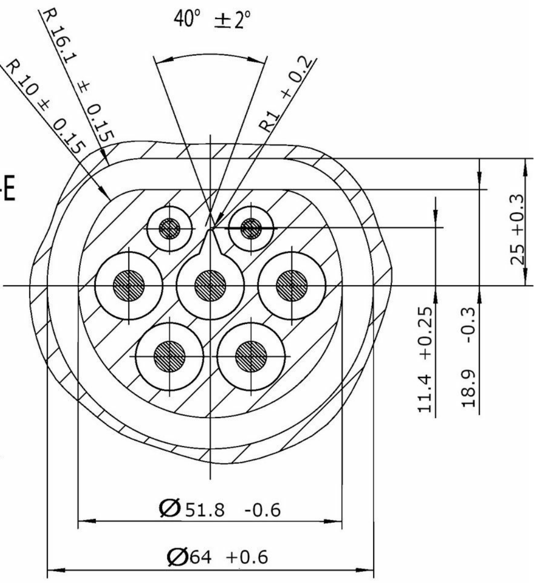
STANDARD SHEET 2-IId

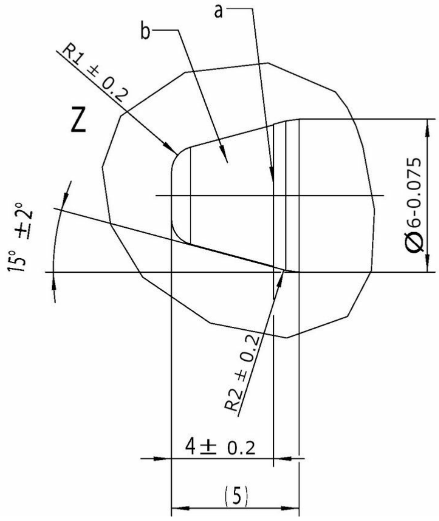
(Clause 9.1 *)*

Sheet 2 ***(*** *Continuation of Sheet 1)*









Key

a	No sharp edges acceptable at the transition region.
b	Isolated cap
c	Latching means positions. At least one latching means provided.

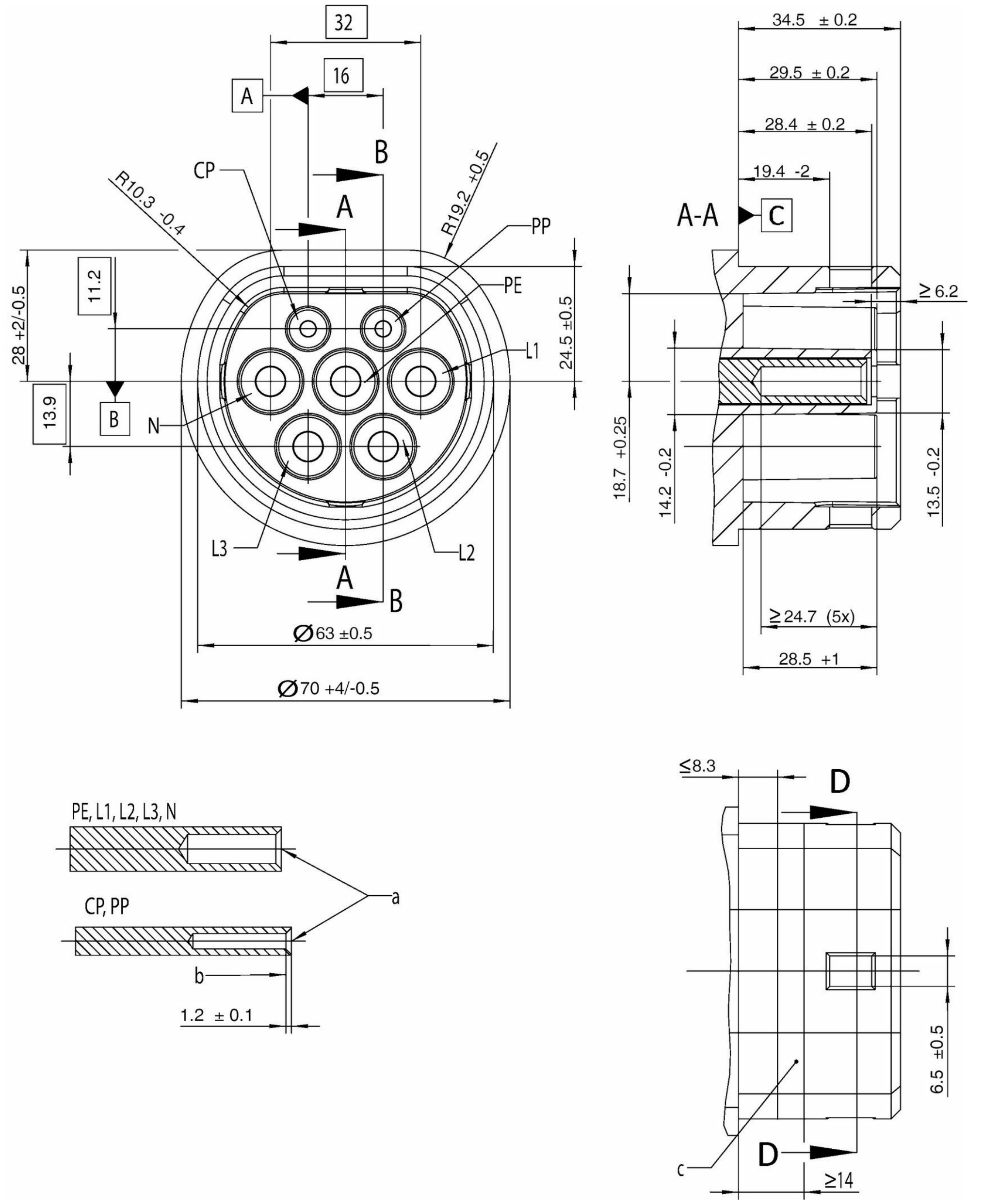
NOTE − Undimensioned radii: R 0.5 mm to 0.7 mm

STANDARD SHEET 2-IIe

(Clause 9.1 *)*

Sheet 1

VEHICLE CONNECTOR
63 A, 415 V THREE-PHASE OR 70 A, 240 V SINGLE PHASE



Key

a.	Tip of sleeves chamfered for easy insertion
b	Contact point.
c	Sealing area free of sinkage, toolcuts and ejectors

NOTES

1 Undimensioned radii: R 0.5 mm to 0.7 mm.

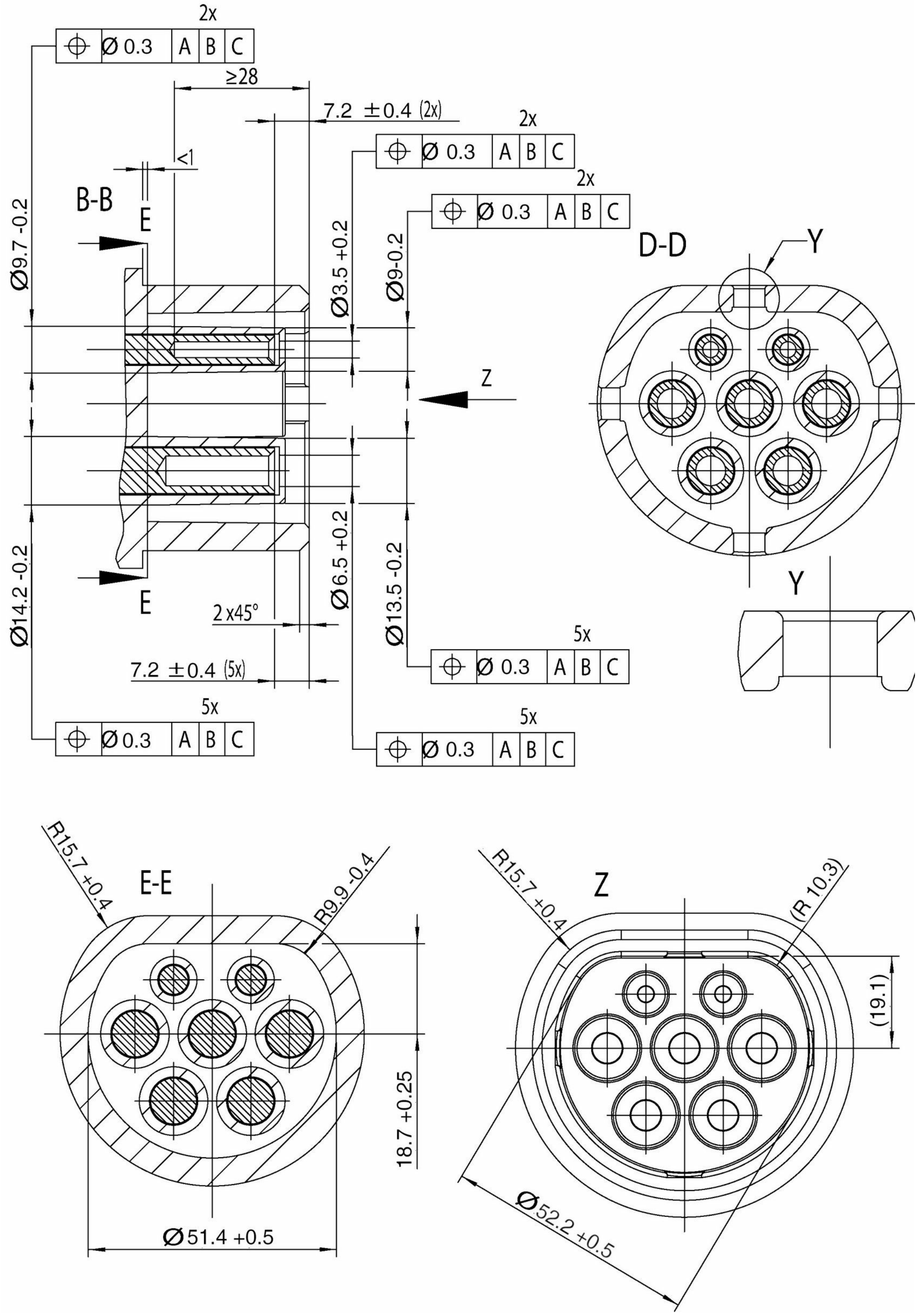
2 Surface roughness in sealing area: Ra=0.7 µm.

3 For single phase connectors the contacts L2 and L3 including the surrounding insulation can be omitted.

STANDARD SHEET 2-IIe

(Clause 9.1 *)*

Sheet 2 ***(*** *Continuation of Sheet 1* ***)***



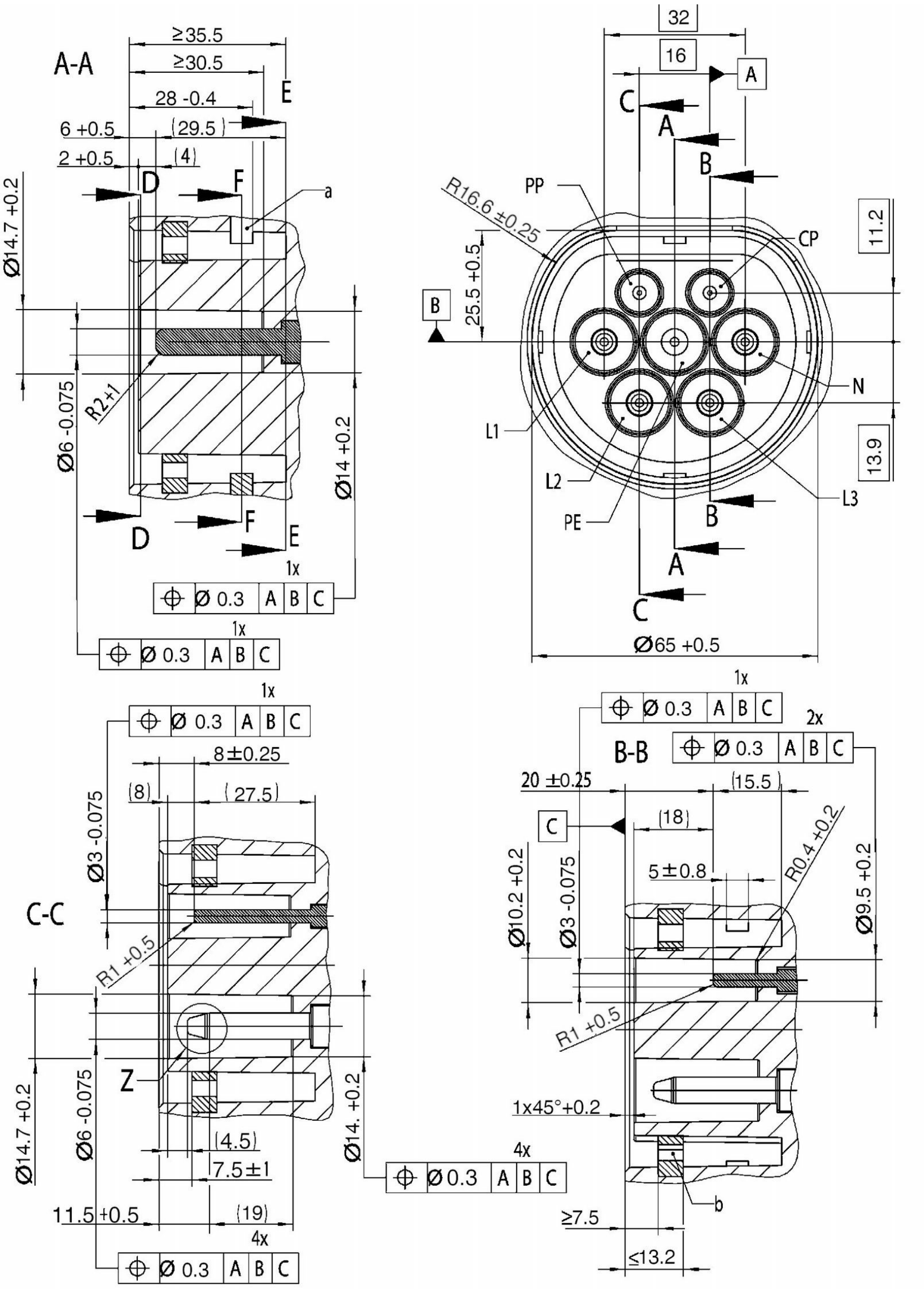
NOTE − Undimensioned radii: R 0.5 mm to 0.7 mm

STANDARD SHEET 2-IIf

(*Clause* 9.1)

Sheet 1

VEHICLE INLET
63 A, 415 V THREE-PHASE OR 70 A, 240 V SINGLE PHASE



Key

a	Latching means construction to customer’s decision
b	Sealing area (optional sealing)

NOTES

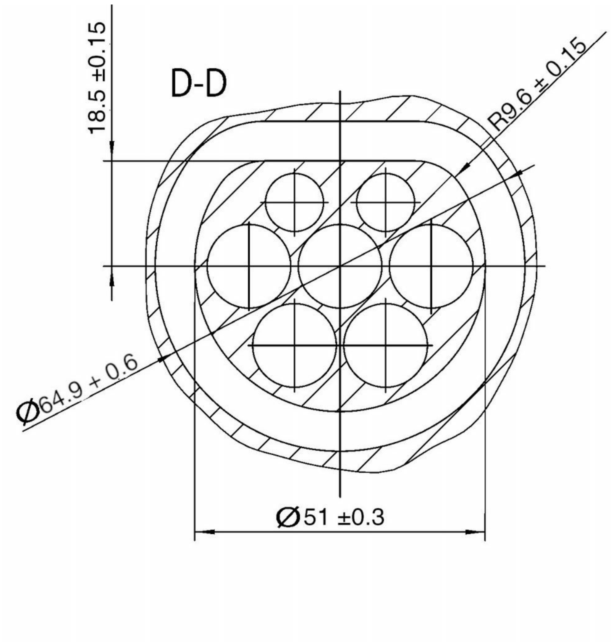
1 Undimensioned radii: R 0.5 mm to 0.7 mm.

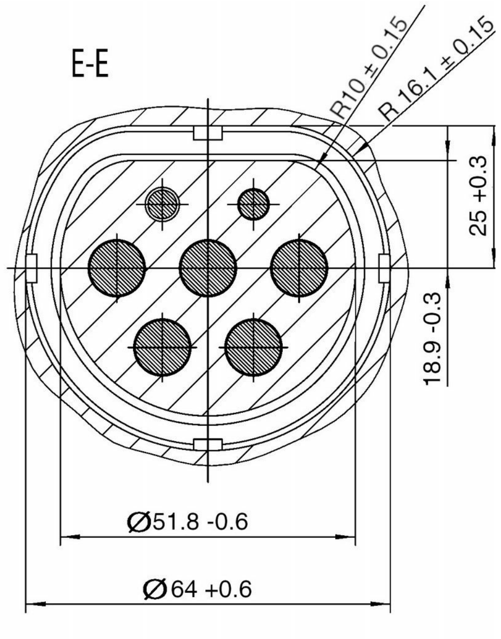
2 For single phase inlets the contacts L2 and L3 can be omitted.

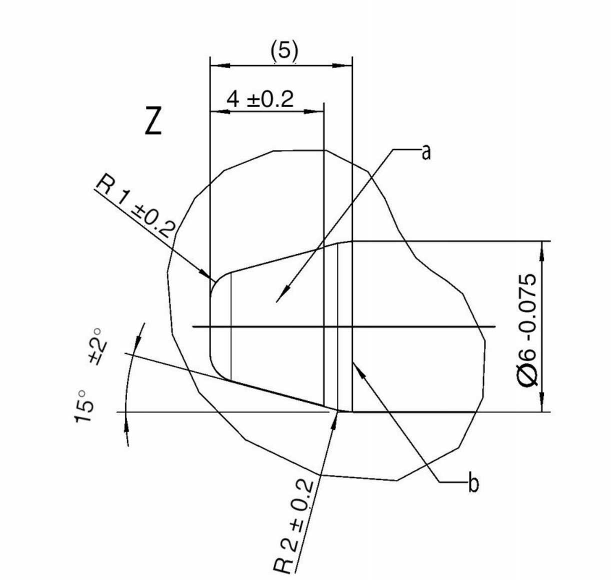
STANDARD SHEET 2-IIf

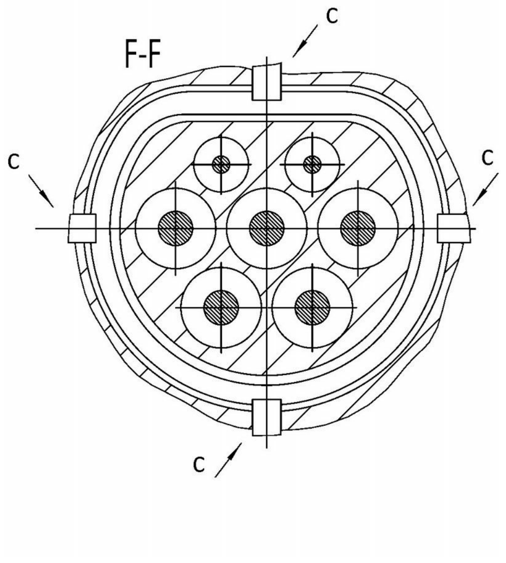
(Clause 9.1 *)*

Sheet 2 *(Continuation of Sheet 1)*









Key

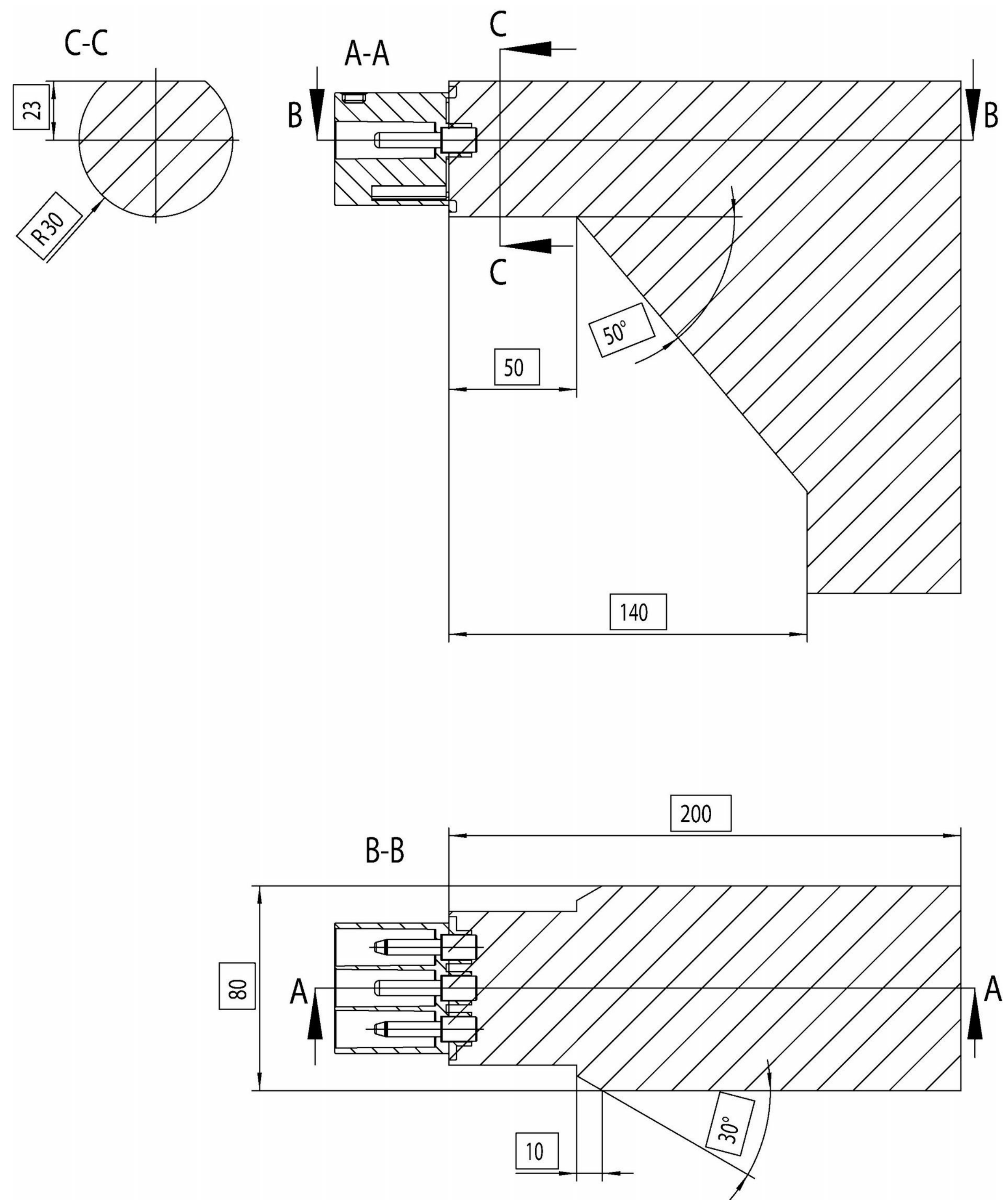
a	Isolated cap
b	No sharp edges acceptable at the transition region
c	Latching means positions. At least one latching means provided.

NOTE − Undimensioned radii : R 0.5 mm to 0.7 mm

STANDARD SHEET 2-IIg

(*Clause* 9.1)

PLUG
PACKAGING ROOM

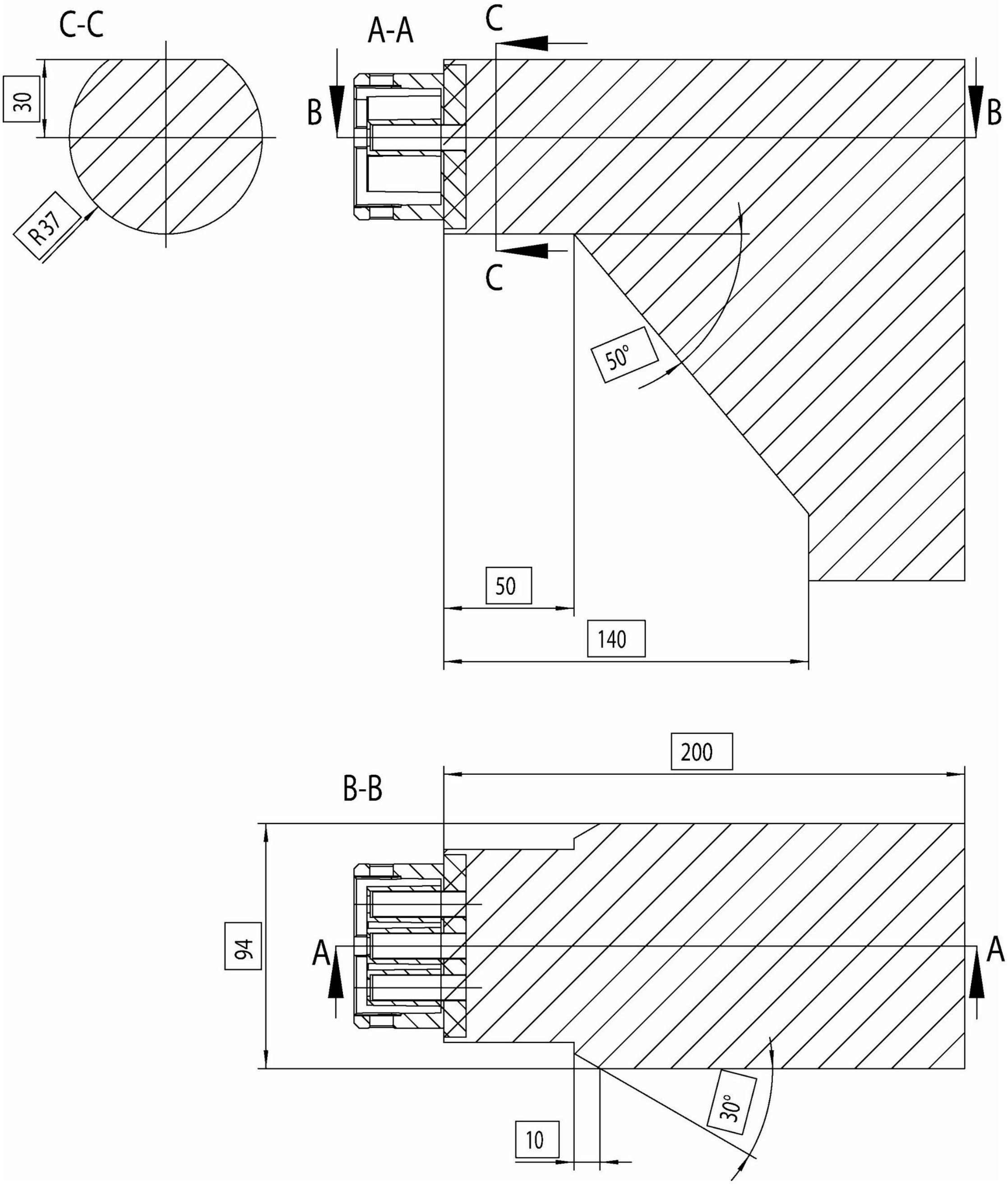


NOTE – Plug body shape shall be within the shaded area.

STANDARD SHEET 2-IIh

(Clause 9.1 *)*

VEHICLE CONNECTOR PACKAGING ROOM



NOTE − Vehicle connector body shape shall be within the shaded area.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Electrotechnology in Mobility Sectional Committee, ETD-51

Organization	*Representative(s)*
Department of Science And Technology, New Delhi, Delhi	Dr Sajid Mubashir (***Chairman***)
ABB India Limited, Faridabad, Haryana	Shri Divya Kumar
Amara Raja Batteries Limited, Tirupati, Andhra Pradesh	Shri Niranjan C Shri Jasmeet Singh (*Alternate*)
Ashok Leyland Limited, Chennai, Tamil Nadu	Shri Arun Kumar Gelli Shri Huzefa A. C. (*Alternate* I) Ms Suchismita Chatterjee (*Alternate* II)
Ather Energy Private Limited, Bengaluru, Karnataka	Shri Swapnil Jain Shri Nishant D. K. (*Alternate* I) Shri Chennasetty Prashanth Manikumar (*Alternate* II)
Automotive Component Manufactures Association of India (ACMA), New Delhi, Delhi	Ms Pooja Sharma Shri Uday Harite (*Alternate*)
Bangalore Electricity Supply Company Limited, Bangalore, Karnataka	Shri Anil Kumar Dsouza
Bharat Heavy Electricals Limited, Lodhi Road, New Delhi	Shri Imran Mansury Shri Pushkar Khakha (*Alternate*)
Bajaj Auto Limited, Pune, Maharashtra	Dr Philip Jose Shri Arvind Kumbhar (*Alternate*)
Bosch Limited, Bangalore, Karnataka	Shri Pradeep Ramachandra Shri Hariprasad Gowrisankar (*Alternate* I) Shri Sanjay Khatri (*Alternate* II)
Castus Energy Solutions Private Limited, Chennai, Tamilnadu	Shri Sivam Sabesan
Center For Study of Science, Technology, and Policy, Noida, Uttar Pradesh	Dr Mridula Dixit Bharadwaj Shri Aumkar Borgaonkar (*Alternate* I) Shri Arunesh Karkun (*Alternate* II)
Central Electricity Authority, R K Puram, New Delhi	Shrimati Vandana Singhal Ms Seema Saxena (*Alternate*)
Central Electricity Regulatory Commission, New Delhi, Delhi	Shri M. M. Chaudhari
Central Power Research Institute (CPRI), Bangalore, Karnataka	Dr Kuldeep Singh Rana
CG Power and Industrial Solutions Limited, Ahmednagar, Gujarat	Shri A. Sudhakaran Shri Sandeep R. Bachkar (*Alternate*)
Council of Scientific and Industrial Research, New Delhi, Delhi	Dr R. P. Aloysius Ms Priyanka Jain (*Alternate* I) Shri Atul Suresh Somkuwar (*Alternate* II)
Delta Power Solutions (India) Private Limited, Gurgaon, Haryana	Shri Akshaye Barbuddhe Shri R. Om Prakash (*Alternate*)
D E N S O International India Private Limited, Gurgaon, Haryana	Shri Noel Alexander Peters Shri Alok Kumar (*Alternate* I) Ms Alka Sharma (*Alternate* II)

Organization	*Representative(s)*
EV Motors India Private Limited, Noida, Uttar Pradesh	Shri Vinit Bansal Shri Nicco Bhabu (*Alternate* I) Shri Vikram Gulati (*Alternate* II)
Exicom Tele-Systems Private Limited, Gurgaon, Haryana	Shri Akshay Ahuja Shri P. M. Singh (*Alternate*)
Fortum India Private Limited, Gurgaon, Haryana	Shri Awadhesh Kumar Jha Shri Chinmay Shukla (*Alternate* I) Shri Ankit Maheshwari (*Alternate* II)
Hero MotoCorp Limited, Jaipur, Rajasthan	Shri Feroz Ali Khan Shri Subrat Kumar Dash (*Alternate*)
Honda Cars R and D India, Gautam Budh Nagar District, Uttar Pradesh	Shri Koji Tamenori Shri Adish Aggarwal (*Alternate* I) Shri S. Muthu Kumar (*Alternate* II)
Honda Motorcycle and Scooter India Private Limited, Gurugram, Haryana	Shri Suraj Agarwal Shri Sandeep Miskeen (*Alternate* I) Shri Vipin Sharma (*Alternate* II)
India Smart Grid Forum, Chanakyapuri, New Delhi	Shri Reji Kumar Pillai Shri Shuvam Sarkar Roy (*Alternate*)
India Yamaha Motor Private Limited, Uttar Pradesh, India	Shri Sanjeev Chugh Shri J. Emmanuel (*Alternate*)
Indian Electrical and Electronics Manufacturers Association, New Delhi, Delhi	Shri Mustafa Wajid, Meher Capacitors, Bengaluru Shri Vivek Arora (*Alternate* I) Shri Pande J (*Alternate* II)
Indian Institute of Technology (IITB), Mumbai, Maharashtra	Prof Sagar Mitra Prof Venkatasailanathan Ramadeigan (*Alternate* I) Prof Kishore Chatterjee (*Alternate* II)
Indian Institute of Technology (IITM), Chennai, Tamil Nadu	Dr Prabhjot Kaur Ms Anitha Dhianeshwar (*Alternate*)
Infineon Technologies India Private Limited, Noida, Uttar Pradesh	Shri Rakesh Sharma
International Copper Association India, New Delhi, Delhi	Shri Debdas Goswami
Mahindra Electric Mobility Limited, Bommanahalli, Bangalore	Dr Allabaksh Naikodi Shri Sreejakumar Nair (*Alternate*)
Maruti Suzuki India Limited, Gurgaon, Haryana	Shri Gururaj Ravi Shri Amit Bharti (*Alternate* I) Shri Sumit Kumar (*Alternate* II)
Masstech Controls Private Limited, Mumbai, Maharashtra	Shri Anurag Patil Shri Subhash N Patil (*Alternate* I) Shri Bhushan Bharambe (*Alternate* II)
Ministry of Heavy Industries, New Delhi, Delhi	Shri A. A. Deshpande Automotive Research Association of India, PuneMaharashtra Shri M. M. Desai (*Alternate*) Automotive Research Association of India, Pune. Maharashtra.
Narnix Technolabs Private Limited, Sector 13 R K Puram, New Delhi	Shri Narang N. Kishor

Organization	*Representative(s)*
Panasonic India Private Limited, Gurugram, Uttar Pradesh	Shri Atul Arya Shri Shailesh Kumar Dubey (*Alternate* I) Shri Yogesh Kumar (*Alternate* II)
Phoenix Contact India Private Limited, New Delhi, Delhi	Shri Amit Tyagi Shri Alok Aggarwal (*Alternate* I) Shri Amit Sharma (*Alternate* II)
Rajasthan Electronics and Instruments Limited, Jaipur, Rajasthan	Shri A K Jain Shri R K Gupta (*Alternate* I) Shri D K Gupta (*Alternate* II)
Renault India Private Limited, Kancheepuram District, Tamilnadu	Shri Vijay Dinakaran Shri Rajendra Khile (*Alternate*)
Siemens Limited, Navi Mumbai, Maharashtra	Shri Bidyut Mazumdaer Shri Amit Kekare (*Alternate*)
Society of Indian Automobile Manufacturers, New Delhi, Delhi	Shri Prashant K. Banerjee Shri Saurabh Rohilla (*Alternate*)
Tata Motors Limited, Pune, Maharashtra	Dr Ajit Kumar Jindal Dr Raja Munusamy (*Alternate* I) Mr Sunil Nagpal (*Alternate* II)
Tata Power Company Limited, Mumbai, Maharashtra	Shri Paresh Bhatt Ms Nushreen Ahmed (*Alternate* I) Shri Manoj Kumar (*Alternate* II)
Tata Power Delhi Distribution Limited, Kingsway Camp, Delhi	Dr G. Ganesh Das
Tech Perspect Software Private Limited, Noida, Uttar Pradesh	Shri Sumit Ahuja Shri Ramesh Arora (*Alternate* I) Shri Vishal Sharma (*Alternate* II)
The Energy and Resources Institute, New Delhi, Delhi	Shri Alekhya Datta Dr Shashank Vyas (*Alternate* I) Shri Neshwin Rodrigues (*Alternate* II)
Toyota Kirloskar Motor Private Limited, Ramanagara District, Karnataka	Shri Channappa Revadi Shri Raju M (*Alternate* I) Shri M. Suchindran (*Alternate* II)
TVS Motor Company, Harita, Hosur	Dr S. Jabez Dhinagar Shri Ravindar Naik (*Alternate*)
UL India Private Limited, Whitefield, Bengaluru	Shri V Manjunath Shri Manish Kothari (*Alternate*)
Vision Mechatronics Private Limited, Thane (W), Maharashtra	Dr Rashi Gupta Mr Bharat Gupta (*Alternate*)
In personal capacity (*506/2 Kirti Apartments, Mayur Vihar Phase 1 extension, Delhi – 110 091*)	Shri P. K. Mukherjee
BIS Directorate General	Shri Rajeev Sharma, Scientist ‘F’ and Head (ETD) [Representing Director General, BIS (*Ex-officio*)]

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